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Compilations of Meteorologically Useful Data From Project "Moby Dick" Section I (of ten sections)

Air Force Cambridge Research Center

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COMPILATIONS OF METEOROLOGICALLY USEFUL DATA FROM PROJECT "MOBY DICK"

Edited By

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July, 1956

SECTION I

(of ten sections)

<u>Flight Numbers</u>

A5-A72
T73-T89

GEOPHYSICS RESEARCH DIRECTORATE

AIR FORCE CAMBRIDGE RESEARCH CENTER

AIR RESEARCH AND DEVELOPMENT COMMAND

SECTION I

Table of Contents

Note: Tables of contents are not included with Sections II through X, since these sections contain only flight data. Flight data contents are indicated on the cover and title sheet of each section.

PREFACE

The purpose of these collections of data is to make available to interested scientists the data gathered during a part of the Air Force project entitled, "The Determination of the Synoptic Wind Field between 50,000 and 100,000 Feet" and nicknamed "Moby Dick". This operational phase involved the launching and tracking of 619 controlled-altitude balloons between 1 January 1953 and 30 June 1954 over the United States. Most of these balloons were set to operate at various levels between 50,000 and 75,000 feet; a few between 35,000 and 45,000 feet.

This operation was a joint undertaking of many agencies. Responsibility for developing and procuring equipment, for coordination and control of operations, and for evaluation of the resulting data rested with the Geophysics Research Directorate, Air Force Cambridge Research Center of the Air Research and Development Command. Holloman Air Development Center was responsible for the testing of balloon launching techniques and for actual launching operations during the first part of the operational program. The launching operations were later performed by personnel from the Air Resupply and Communications Service and from Headquarters Command, United States Air Force. The Airways and Air Communications Services of the Military Air Transport Service was responsible for tracking the balloons with VHF/DF equipment, and they were assisted in this undertaking by the Navy and the Civil Aeronautics Authority. The Federal Communications Commission tracked a number of balloons launched from Sedalia AFB, Missouri, with HF/DF equipment. The observations were transmitted by Flight Service of the Airways and Air Communications Services to a plotting center at Lowry AFB,

Colorado, manned by the Air Weather Service of the Military Air Transport Service. Plotting center personnel monitored reports concurrently with the balloon flights concerned and issued forecasts of the time and place of flight termination.

These data collections result from the coordinated activities of Consultants & Designers, Inc., of New York City (Contract AF 19(604)-719), Drs. R. A. Craig and W. K. Widger, Jr., and Messrs. T. Borden, S. Giglio, and M. L. Haas of the Atmospheric Analysis Laboratory, Major T. Haig, Major E. Doty, Lt. H. Crane, and A1/C J. Dwyer of the Atmospheric Devices Laboratory, Capt. M. Lyga of Headquarters Command, USAF, and Mr. J. Downs of Wentworth Institute (Contract AF 19(604)-758).

Results of the test flights made during the developmental phases of the Moby Dick equipment and descriptions of the instrumentation of these flights were reported in Progress Reports 9, 10 and 11 of Contract AF 19(122)-63 by the Department of Electrical Engineering, Tufts College, Medford, Massachusetts, and AF Surveys in Geophysics No. 30. However, a brief description of the balloon, instrumentations and launching devices is given here for the benefit of those unfamiliar with previous reports.

I. Balloon and Instrumentation

A. Balloon

The balloons were fabricated by heat sealing many vertical gores of 2.0 or 2.5 mil polyethylene film. Load bearing members of glass filament-backed pressure-sealing adhesive tapes one inch wide were applied over the gore seams. Balloons of three design shapes were used. The first was that of a sphere with a tangent cone base. The second was a newly developed natural shaped balloon and the third was a balloon of

cylindrical shape. Balloons manufactured for this project were of four sizes by volume: 28,885 cu. ft., 49,100 cu. ft., 150,000 cu. ft. and 223,000 cu. ft. Contractors furnishing these balloons were: Winzen Research, Inc. under contracts AF 19(604)-367, AF 19(604)-770 and AF 19(604)-1062; General Mills, Inc. under contracts AF 19(604)-465 and AF 19(604)-474; and Molded Latex under contract AF 19(604)-485. Table I gives the classification of these balloons by size, diameter, shape and manufacturer.

B. Parachute

A standard silk or nylon 24-foot diameter, flat canopy, personnel parachute was used to deliver the instrument container to the ground after the flight terminated. The parachutes were packed in cardboard cartons placed on top of the instrument inclosure. A static line from the top of the canopy was tied to the rip panel of the balloon, and a small pilot parachute was fastened to the static line as a drag chute.

C. Instrument Inclosure

All instruments and equipment, except a "cut-down device" and an antenna, were contained in an insulated container about 22 x 19 x 22 inches in size. Two containers capable of holding up to 130 pounds each of fine steel dust ballast were fastened on each end of the package. The inclosure frame was made of welded angles of 16-guage sheet steel. The remainder of the inclosure was made up of three one-inch styrofoam and aluminum foil laminations. A cardboard box containing the equipment fitted the inside, and the inclosure was suspended from the top corner points.

TABLE I

MODIFIED BALLOON CODE

CODE FOR BALLOON SIZE, MANUFACTURER, AND SHAPE

The code for the balloon size, manufacturer, and shape will be a two (2) letter group.

First letter represents balloon size as shown below:

L - Large size	GM - 79' dia. balloon - spherical Winzen - 73' dia. balloon - spherical Winzen - 80.2' dia. balloon - cylindrical Winzen - 83.3' dia. balloon - natural
M - Medium size	GM - 69' dia. balloon - spherical Winzen - 61' dia. balloon - spherical Winzen - 70.2' dia. balloon - cylindrical Winzen - 72.3' dia. balloon - natural
N - Small size	GM - 47' dia. balloon - spherical Winzen - 45' dia. balloon - spherical Molded Latex - 45' dia. balloon - spherical Winzen - 48.4' dia. balloon - cylindrical Winzen - 49.2' dia. balloon - natural
P - Small size	Winzen - 39.49' dia. balloon - natural

Second letter represents balloon manufacturer and shape as shown below:

A - Winzen, Base Inflation only (spherical shape)

B - Winzen, Base and Side Inflation (spherical shape)

C - GM, Base Inflation, Heat Sealed Tapes

D - GM, Base and Side Inflation, Heat Sealed Tapes

E - GM, Base Inflation only

F - GM, Base and Side Inflation

G - Molded Latex, Base Inflation

H - Molded Latex, Base and Side Inflation

I - Winzen, Cylindrical

J - Winzen, Natural Shape, Base appendix only

K - Winzen, Natural Shape, Base and Duct appendices

D. Instrumentation, Heat Supply and Power Supply

Information as to the identity of the particular flight, the altitude of the balloon and the amount of ballast expended was transformed into electrical impulses in the form of the Morse code by a coder. This instrument was designed so that a record, modulated with 210 two-letter Morse-code combinations, was driven past two pickup arms whose positions varied with the altitude and ballast consumption respectively. Radio transmissions were of thirty seconds duration followed by ninety seconds of silence. The transmissions consisted of fifteen seconds of steady tone for direction-finding purposes followed by two code cycles, each containing the balloon identification, the altitude, and the ballast expended.

Programming for the entire electrical system was accomplished by means of a control unit which not only regulated the spacing and duration of signals, but also coordinated ballast supply and demand and insured proper sequencing of the safety features.

An aneroid cell mounted to operate a specially sensitized micro-switch was motor-driven to withdraw the cell as the balloon ascended. After reaching peak altitude, the cell collapsed as the balloon descended so that after a pre-set pressure change the micro-switch was closed causing magnetic valves in the ballast hoppers to open and release steel dust at a rate of about thirty pounds per hour. When the balloon ascended again a small pre-set distance, the contact was opened by the cell and ballast flow ceased.

Telemetering of the coded information was accomplished by using a crystal controlled transmitter operating on 138.060 megacycles or, as in

a few cases, a small HF transmitter was substituted. Radiated output from this system varied from about 14 down to 10 watts as the battery discharged. The transmitters in both cases had outside antennae, the former using a VHF dipole antenna approximately forty inches long suspended from the bottom of the instrument container and the latter employing an end-fed zepp suspended from a reel on the side of the container.

The required thermal stability within the container was accomplished through the use of cans containing water. The heat of fusion of the water maintained a temperature near 0°C, thus allowing proper operation of the equipment and preventing the freezing of the battery power source.

The battery source used was a standard 6 volt, 120 amphere-hour automotive storage battery. The high voltage was obtained for the VHF transmitter by using a vibrator transformer while a dynamotor supplied the required voltages for the HF transmitter.

E. Safety System

In addition to the parachute described in B, the following safety features were included in all operational flights:
(a) A rip device was included in the balloon which would destroy the balloon after the load was dropped by parachute. (b) The ballast weight was jettisoned whenever the flight terminated for any reason. The total load on the parachute was then the instrument without ballast or about 135 pounds. (c) Two flashing warning lights operated on the instrument whenever it was below 30,000 feet. (d) The thermal package contained an electrical system which would sever the load line above the parachute by means of a squib if the balloon had not reached 30,000

feet within 2½ hours after launching. The load line would be severed also if the balloon began descending before reaching 30,000 feet, or if the balloon descended below 30,000 feet after the 2½ hour period. (e) The cut-down device located above the parachute contained a mechanical cutter which would terminate the flight independently of the electrical system in the thermal package and under the same conditions as in "d" above.

F. Launching Procedures

Although balloon launchings are so sensitive to local weather conditions that no two launchings are identical, in general, the procedure was as follows: The balloon was carefully laid out on a canvas ground cloth and the top of the balloon was then placed in the launching wagon by handling the canvas. This launching wagon enabled balloon launchings during winds of up to 25 knots in velocity. It consisted of a forty-foot flatbed trailer extended in width with high sides, one high end panel and a canvas top equipped to be released simultaneously along one or all sides. The volume of the wagon inclosure was about 14,000 cu. ft. The balloons were inflated with helium from Navy gas trailers, and the load was fastened to the balloon. A restraining line was also added to the balloon base. At the launching signal, the wagon cover was released along the upwind side and the end, and the balloon ascended rapidly from the wagon. To prevent dragging the load, which was mounted on a wheeled cart, the base of the balloon was restrained and the load moved under it until pick-up was accomplished.

II. Arrangement of Data

Except for the probable positions listed for each group of reports, the flight data reported herein are primarily intended to be "raw data"

free of interpretation. These basic data were received at the Lowry Plotting Center. Duplicate teletype records of all incoming and outgoing messages pertaining to Moby Dick balloons were furnished by the plotting center to the Geophysics Research Directorate. Consultants & Designers, Inc., under Contract AF 19(604)-719, processed the data, separated the messages pertaining to each balloon, and determined the probable positions. The data pertaining to each balloon are given here in several parts as follows:

A. Summary Sheet

This sheet describes briefly the characteristics of the balloon used and its performance. Flights are designated by a letter and number combination. The letter indicates the launching site used as follows:

Name of Site	Latitude (N)	Longitude (W)	Designated by Letter
Tillamook NAS, Oregon	46.1	123.9	A, or T after 1 Aug 1953
Vernalis NAS, California	37.6	121.3	B, or V after 1 Aug 1953
Edwards AFB, California	34.9	117.9	C, or E after 1 Aug 1953
Sedalia AFB, Missouri	38.6	93.6	S or K
Moody AFB, Georgia	30.8	83.3	M

Flights from each launching site are numbered chronologically. The size and type of balloon is coded according to Table I. Impact information is supplied in the case of package recovery. Other items are self-explanatory.

B. Altitude Calibration Sheet

This sheet gives the pressure-altitude of the balloons, in thousands of feet, corresponding to the code letter transmitted by the balloon, assuming a standard atmosphere.

C. Flight Data

1. General Information

The station receiving the balloon transmission is indicated by its standard call-letters most of which are given in "Radio Facility Charts and Supplementary Information, United States" published by the U. S. Air Force and the U. S. Navy. An exception is the abbreviation "LS" which refers to the launching site for the balloon in question. When the launching site finds no change in balloon altitude and ballast consumption during a consecutive number of observations, the unchanging observation is listed only once, together with the number of times and the time interval during which the observation was repeated. Call letters marked by an asterisk indicate that the message was not clearly marked in the teletype log as referring to the balloon under which it is listed; the possibility exists that it refers to another Moby Dick balloon if one was in the same vicinity. The contractor, however, has exercised his best judgment in applying the data to this particular balloon.

In the "Altitude" column, the reported code letters are given exactly as they appear in the original messages. Occasionally code letters are misinterpreted by the observer, resulting in an indicated altitude that is clearly inconsistent with those that precede and follow it. The altitude-calibration sheet for each flight is an aid in

resolving such inconsistencies.

The same applies to the ballast consumption. The code letters are interpreted as follows: the first code letters transmitted correspond to zero ballast expenditure, each subsequent pair of letters on the altitude calibration sheet corresponds to one "groove" on the transmitting record. The ballast factor, given under remarks on the summary sheet, determines the number of pounds of ballast expended per groove. (If the ballast factor is not included on the summary sheet use the factor 0.73).

Only one third of the flights were instrumented to transmit ballast data, and almost all of these flights were made from Vernalis NAS, California (Site B or V).

The balloon positions resulting from the HF/DF flights launched at Sedalia AFB, were determined by the Federal Communications Commission (FCC) from bearings taken by their monitoring stations. The bearings for any one position fix approximate a circle of error of particular size. If the circle of error is sufficiently small, as defined by the FCC, the center of the circle is given as the balloon's position. If the circle is larger than that defined, FCC weights each bearing and adjusts the final position accordingly.

For the VHF/DF flights, all monitoring stations were instructed to report the magnetic inbound (balloon-to-station) bearing. The bearings, given herein, are in all cases the reported bearing, corrected to become true outbound bearings for the convenience of the reader who may wish to

plot some of the fixes. Occasionally, there is good reason to believe that the monitoring stations actually reported either true inbound, magnetic outbound, or true outbound bearings. Bearings marked with an asterisk are typed as if they were "magnetic inbound" on the teletype log, but in the determination of position the contractor has assumed that they are incorrect by 180°. The letters that follow the bearings are the monitoring stations' estimates of bearing accuracy, "A" being the best bearings, "C" the poorest.

The VHF/DF positions have been determined on a Gnomonic projection with scale $1:4 \times 10^6$ and with point of tangency near St. Joseph, Missouri. With this projection, a great circle on the spherical earth becomes a straight line on the map. There is some angular distortion, but it is not large enough to require correction over the area represented by the United States. (Farther from the point of tangency, this error rapidly becomes very large). We have tried to adhere to a method of position determination that is as objective and reproducible as possible. Errors in the bearings, and the ever-present difficulty that some stations did not always report magnetic inbound bearings, have made this difficult. There is often room for personal judgment, and the reader should feel free to examine the position given and decide whether he wishes to make a different interpretation. The following rules have governed the position determination.

a. If two or more bearings do not form any intersection, we do not try to supply a position.

b. If two bearings intersect, we use the point of intersection for the position.

c. If three bearings form a triangle, we estimate a position by changing each of the three bearings through an equal angle until the three intersect at a point.

d. If, in the case of three bearings, two intersect and the third appears to be widely inconsistent, we try reversing the direction of the third one by 180° (on the assumption that the station reported an outbound rather than inbound bearing). If this results in the formation of a triangle we follow 3. If not, we use an approximate method of least squares (see below).

e. If, in the case of four or more bearings, more than 50 miles separates any two points of intersection, we use an approximate method of least squares (see below).

The method of least squares was derived for cases where three or more bearings were so inconsistent that a graphical method of position determination left considerable uncertainty in the position. In this method, the sum of the squares of the angular deviations (reported bearings minus bearings implied by final selected balloon position) is minimized.

2. Accuracy of Balloon Position Fixes

The problem of ascertaining the accuracy of VHF/DF balloon position fixes is a difficult one for several reasons. First, the exact geographical position of the balloon is generally not known, except in the rare cases where theodolite, airplane, or direct visual fixes are available. Even these methods are subject to a small amount of error. Secondly, position fixes are not completely accurate because of

variations in the performance of balloon-borne radio equipment, tracking equipment and individual tracking stations. Third, many tracking stations located in or near mountainous terrain are subject to errors caused by local topography. Finally, the accuracy of any one bearing is generally a function of the balloon's distance from the tracking station.

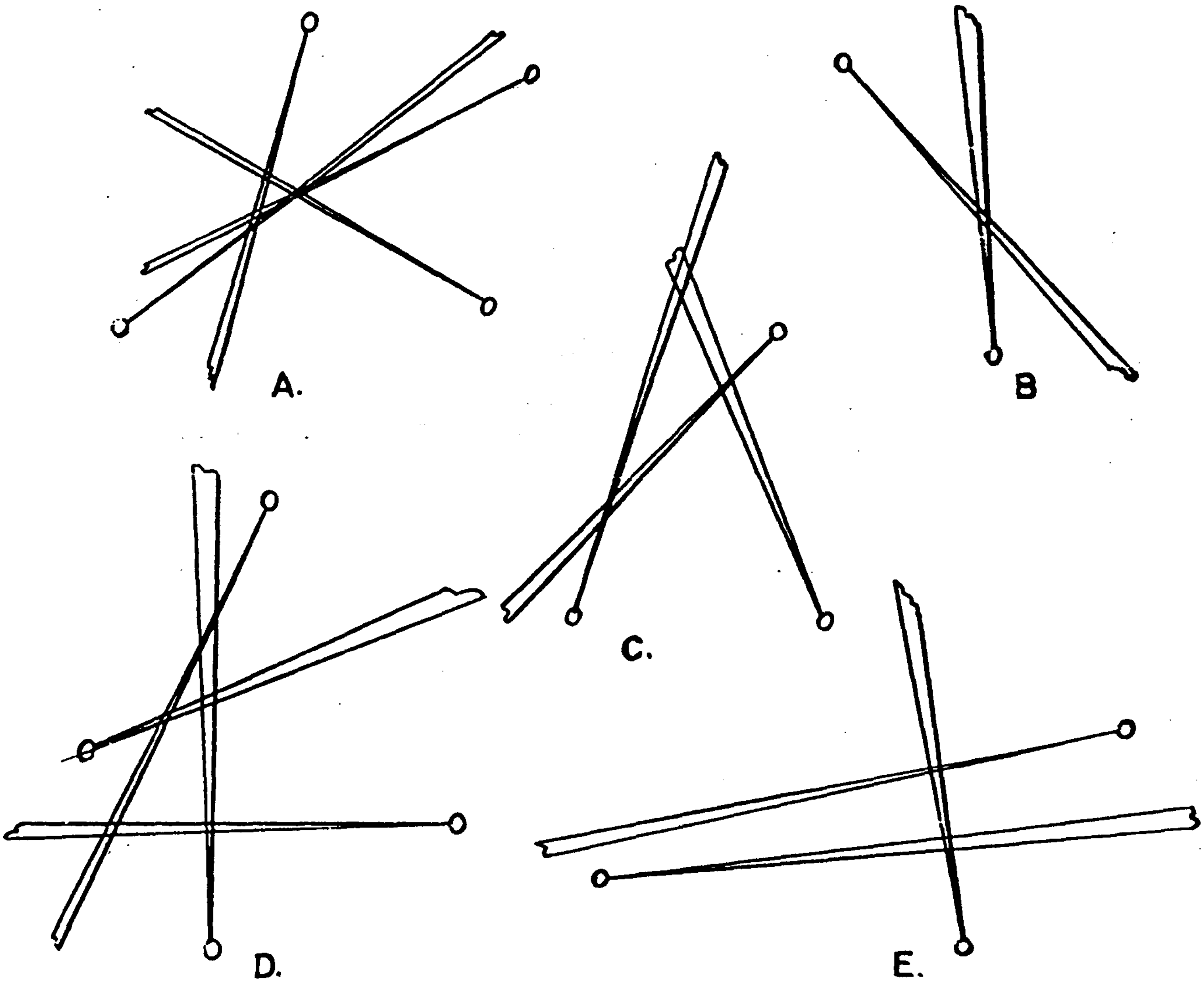

FIGURE I.

Typical Moby Dick Bearing Complexes

(DF Stations Are Denoted by Small Circles.)

Figure I is a schematic diagram of a few of the typical bearing triangulation complexes that were encountered. A study of the diagrams should convince the reader as to the need for the "least squares" method of position determination mentioned earlier. Diagram "A" is considered as a most desirable array of bearings, assuming that no two intersections are more than 50 miles apart. Diagram "B" illustrates a fix that is derivable graphically but is subject to gross errors due to minute variations of either or both bearings. Diagrams C, D, and E illustrate problems requiring "least squares" solution.

A study made at the University of Minnesota under Contract AF 19(604)-1166, estimates that the standard deviation of the VHF/DF fixes, from a small sample of seven flights, ranges between 16 and 32 miles. Therefore, as a first approximation, the majority of the VHF/DF position fixes are estimated to be accurate within 32 to 64 miles (in round numbers 30 - 65 miles), assuming the position errors are normally distributed. This estimate is the best available at this writing.

The FCC/HF/DF tracking network uses the following classifications for its balloon position fixes, based upon the circle of error inclosing the most probable position of the balloon:

Rating		Radius of Area
(G) Good	-	20 miles
(F) Fair	-	40 miles
(P) Poor	-	60 miles

(E) Estimated - determined by less than four bearings or based upon the previous track or scattered bearings.

It should be noted that the Good, Fair, and Poor ratings are based upon a minimum of four bearings. Further details on the FCC method of determining position fixes are not available.

The FCC HF/DF network was employed on a number of flights (the K-series) launched from Sedalia Air Force Base, Missouri. A tabulation of the classifications of the FCC fixes has been included with each of the "K" flights.

D. Trajectory Map

This small-scale map gives the approximate trajectory of the balloon. It is intended to supply rapid visual information to the reader and not to be in sufficient detail for analysis work, wind determination, etc. Date-time positions have been marked on the trajectories with the first two figures indicating the date and the last four figures the time (GMT) on the 24-hour clock. In addition, the title box of each map contains the inclusive dates of the flight and the most appropriate range of altitude in thousands of feet (denoted by M).

III. Criteria for Selection of Useful Data

The trajectory data included in this distribution were selected as being "meteorologically useful" on the basis of certain minimum criteria. These criteria, based on the flight duration and the number of fixes, were defined in order to preclude the distribution of a number of data that were selected as being non-usable meteorologically.

The minimum criteria for the selection of useful trajectory data are as follows:

1. Any AACS VHF/DF flight with one or more fixes not less than twelve hours after time of launch.

2. Any AACS VHF/DF flight with two or more fixes at least five hours apart.

3. Any FCC HF/DF flight with one or more fixes not less than four hours after time of launch.

4. Any flight of not less than four hours duration that is concurrent for at least four hours with other useful flights.

Several master files containing tabulations of data for all flights made under Project "Moby Dick" will be maintained at the Geophysics Research Directorate, Air Force Cambridge Research Center.

IV. Description of Indexes

The flight data in this compilation are arranged chronologically by launch site in the following order:

A and T flights (launched at Tillamook)

B and V flights (launched at Vernalis)

C and E flights (launched at Edwards)

K and S flights (launched at Sedalia)

M flights (launched at Moody)

To assist the reader in locating information on a specific balloon flight, three indexes have been prepared.

The Index of Flights by Altitude contains an arrangement of flights in increments of 5,000 feet of altitude, beginning at 35,000 feet. The index gives the most frequent floating altitude for any particular flight.

The Index by Launching Dates gives, in addition to the launching date and time, the duration to the last fix, the last position fix and the impact point (where the balloon equipment was found).

The Data Compilation Index by Sections locates the flight data with respect to the ten sections or volumes making up the total compilation.

Index of Flights by Altitude

35-40,000 (feet)

V104	E185
V109	
V114	

40-45,000 (feet)

T134	V98	E153	E189
	V178	E172	E190
	V181	E173	E194
	V191	E182	E196
		E186	E198
		E187	E199
			E200

45-50,000 (feet)

V115	E150	E193
V145	E168	E195
V179	E184	E197
*V180	E192	
V185		
V186		

50-55,000 (feet)

A23	B5	C5	K3	M7
A29	B12	C11	S8	
A32	B16	C14	K11	
A34	B17	C23	K15	
A38	B19	C25		
A47	B31	C28		
A58	B37	C34		
A59	B40	C36		
A64	B41	C39		
A65	B67	C42		
A70	B70	C46		
T76	B71	C48		
T77	B79	C49		
T78	B84	C52		
T84	V88	C54		
T85	V90	C55		
T87	V93	C61		
T89	V96	C62		
T90	V97	C65		
T91	V100	C66		
T93	V102	C69		
		C71		

Index of Flights by Altitude (cont.)

50-55,000 (cont.)

T94	V110	C72
T95	V112	C73
T96	V120	E74
T97	V122	E80
T99	V123	E81
T100	V124	E82
T101	V126	E84
T102	V131	E85
T103	V132	E87
T104	V134	E88
T105	V136	E90
T106	V139	E93
T107	V141	E95
T108	V143	E96
T110	V148	E101
T112	V149	E102
T113	V150	E104
T116	V153	E105
T118	V154	E106
T119	V155	E107
T120	V158	E110
T121	V159	E111
T122	V162	E113
T124	V165	E114
T125	V166	E115
T128	V171	E116
T129	V174	E117
	V175	E119
		E120
		E121
		E122
		E127
		E134
		E137
		E138
		E139
		E140
		E141
		E147
		E154
		E161

Index of Flights by Altitude (cont.)

55-60,000 (feet)

*A14	B53	C12	S2
A17	*V151	C18	*K12
A31	V160	C26	K29
*A53		C33	K31
A63		C57	
T73		E76	
*T98		*E97	
		E98	
		E103	
		E124	
		E126	
		E142	
		E144	
		E152	
		*E160	
		E170	

60-65,000 (feet)

A10	B6	C15	M8
A33	B14	C16	
A67	B20	C38	
T86	B44	C50	
T127	B73	E75	
T136	B74	E123	
T140	V89	E166	
T147	V91	E178	
	V95		

Index of Flights by Altitude (cont.)

65-70,000 (feet)

A21	B1	C10	K19	M10
A26	B11	C31	K26	
A27	B18	C32	K35	
A39	B23	C40		
A40	B26	C41		
A41	B27	C43		
A44	B35	C47		
A46	B38	C59		
A52	B39	C63		
A71	B46	C68		
T74	B48	E79		
T75	B49	E83		
T79	B51	E128		
T92	B61	E129		
T131	B72	E132		
T132	B83	E156		
T135	V103	E159		
T145	V147	E164		
	*V152	E181		
	V164			
	V172			
	V176			

70-75,000 (feet)

A30	*B2	C3	K5	M13
A50	B22	*C6	K7	
A72	B30	C20	K18	
T80	B32	C51	K22	
T82	B45	C58	*K36	
	*B76	C70	K41	
	*B85	E167	K44	
	V177	E169		
		*E176		
		E201		

75-80,000 (feet)

*T141	B29	C22	K9	M14
	B34	C30	*K20	
	B42	C35	K39	
	*B63	*E165		
		E175		

* - indicates that the actual altitude is uncertain or unknown and that the flight is placed in this altitude range on basis of the theoretical floating altitude as obtained from gross load and balloon volume charts for helium inflated balloons.

Compilations of Meteorologically Useful Data from Project "Moby Dick"

Addenda

1 August 1956

TO: Index by Altitudes

75-80,000 (feet)
A5
A7

40-45,000 (feet)
V198

45-50,000 (feet)
V87

TO: Index by Launching Dates

Date/Time of Launch (Z)				Flight Nos.	Duration (Hrs)	Last Airborne Fix		Impact
1953	January	20	1707	A5	7.9	47.7	123.4	—
		26	1647	A7	7.2	46.1	119.5	—
1953	May	01	1644	V87	5.3	36.2	116.5	
1954	June	24	1535	V198	8.4	37.5	119.6	

TO: Data Compilation Index by Sections

Section No.	Flight Nos.
IV.	V87-V150
V	V151-V198 C3-C35

Index by Launching Dates

Date/Time	Launch (Z)	Flight Nos.	Duration (hrs.)	Last Airborne Fix	Impact
1953 Jan 08	1505	B1	80.9	33.9N 85.8W	
10	1301	B2	16.0	38.5 114.0	Embry, Miss.
16	1315	B5	52.3	43.4 78.9	
18	1326	B6	15.6	32.2 117.3	
24	1515	C3	21.3	34.8 112.7	Fountain, Colorado
28	1520	C5	30.7	27.5 97.8	
30	1502	B11	20.5	31.2 115.4	Concepcion del Oro, Zacateras, Mexico
30	1515	C6	13.8	31.7 115.4	St. Petersburg, Fla.
Feb 01	1555	B12	51.1	33.0 79.0	
	1623	A10	57.6	31.2 103.1	
03	1600	B14	10.5	37.8 117.9	Morrison, Colorado
04	1512	C10	48.3	31.1 81.2	
05	1806	B16	11.4	32.2 112.9	
06	1500	C11	13.0	32.7 112.2	Consulado, Mexico
	1506	B17	20.9	30.0 110.3	Juan Aldama, Zacateras, Mexico
07	1500	C12	29.0	30.2 101.7	
	1600	B18	13.4	34.2 118.7	
08	1551	B19	30.2	36.2 106.2	12 S St. Francis, Kansas
	1621	A14	30.7	33.3 111.1	4 S Anton Chico, New Mexico
10	1550	B20	30.6	31.0 109.2	
	1634	C14	42.4	38.6 89.8	
11	1650	C15	81.2	31.1 95.2	Trinity, Texas
12	1656	C16	7.6	33.8 117.3	
	2016	B22	32.7	33.8 118.7	

Index by Launching Dates (cont.)

Date/Time	Launch (Z)	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Feb 13	1645	B23	55.8	31.9	114.5	
	1658	A17	33.0	34.4	114.1	No. Range, Arizona
14	2023	C18	24.6	33.3	104.8	3W Goodlet, Texas
16	1702	C20	63.5	33.1	83.1	
	1841	B26	18.8	35.6	111.4	
17	1557	B27	35.6	37.2	105.1	Sheridan Lake, Colorado
18	1730	C22	5.5	34.6	114.5	
19	1635	B29	15.4	34.1	115.2	14SW Casa Grande, Arizona
	1704	C23	5.9	32.5	112.7	
20	1608	B30	29.4	35.0	115.1	10S Kirkland, Arizona
21	1648	B31	57.2	38.6	72.0	
	1705	C25	39.4	39.3	93.8	
	1717	A21	81.7	35.8	112.1	35N Flagstaff, Arizona
22	1713	C26	9.8	34.5	114.4	
	1722	B32	9.6	35.5	120.6	4N-11E Springfield, Colorado
23	1632	A23	12.5	39.1	120.5	12NW Lena, Mississippi
25	1505	C28	37.9	37.5	77.5	
	1737	B34	9.4	37.7	122.7	37.3N 122.8W
26	1553	B35	37.6	36.9	115.8	
	1623	A26	21.1	41.1	121.3	22N Coaldale, Nev.
27	1628	A27	36.0	35.0	112.4	
	1646	C30	11.7	35.1	114.7	13S Woodward, Oklahoma
28	1634	C31	13.9	35.2	111.6	Aanado, Arizona

Index by Launching Dates (cont.)

Date/Time	Launch (Z)	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Mar 01	1707	A29	39.4	36.2N	110.8W	Barnum, Iowa
	1717	C32	26.2	37.1	110.9	4WSW Ashby, Neb.
02	1653	C33	25.6	40.8	98.4	Crandon, Wisconsin
	1915	A30	55.8	40.0	122.8	Garden Valley, California
03	1700	C34	9.5	36.3	110.3	
04	1634	B37	22.4	37.2	105.3	Thompsonville, Illinois
	1636	A31	7.9	43.5	119.7	
	1717	C35	77.7	33.4	90.2	
05	1655	A32	36.1	39.0	83.0	
	1715	C36	7.3	35.5	111.8	
	1920	B38	36.2	35.6	109.5	
06	1759	B39	56.5	35.7	110.2	Hoehne, Colorado
	1850	A33	79.2	35.8	85.3	Iotta Valley, Tenn. River, Tenn.
07	1616	A34	12.7	45.2	120.2	
	1705	C38	51.9	35.2	96.3	630E Miami, Florida
	1750	B40	44.7	37.9	89.9	
08	1712	B41	7.3	39.0	118.2	3N-5E Auburn, Nebraska
	1934	C39	25.9	39.6	97.0	
09	1705	B42	57.4	39.7	86.2	Kitty Hawk, N.C.
	1720	C40	60.2	39.0	93.3	4-1/2SW Palmyra, Missouri
10	1745	C41	25.3	37.5	105.0	
11	1825	C42	22.6	40.9	91.9	
12	1623	A38	7.6	45.3	118.0	Grande Round, Washington
	1703	C43	32.5	39.0	106.3	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Mar 13	0021	B44	13.2	37.8N	112.1W	30NE No. Platte, Neb.
	1424	B45	21.6	38.7	116.5	18N Ogallala, Neb.
	1645	A39	9.8	44.2	120.7	
14	1623	A40	8.6	45.7	121.5	NE Corner, Sanders County, Montana
	2040	B46	21.3	38.5	111.7	
15	1648	A41	12.7	46.1	117.1	9NE Webster, No. Dakota
	1715	C46	31.3	37.0	86.3	
16	1330	B48	12.0	38.6	116.9	
	1655	C47	39.1	38.7	88.2	Bloomington, Monroe County, Ind.
17	1700	C48	30.0	39.6	86.2	Lonaconing, Maryland
18	1652	A44	11.1	47.2	119.5	
	1727	C49	30.1	38.8	84.8	
20	1646	A46	9.2	44.2	120.5	2SE Farson, Wyoming
23	1723	A47	8.6	45.8	118.0	7NW Enid, Okla.
24	1648	B49	38.7	40.3	118.9	3SE Birchtree, Mo.
	1818	C50	22.2	39.0	115.4	Clay County, Teges, Kentucky
28	1554	C51	38.1	32.6	113.1	8E New Albany, Mississippi
30	1656	B51	33.6	36.7	114.8	6W Nederland, Texas
	1700	C52	12.5	33.3	110.8	10E Ft. Wayne, Indiana
	1946	A50	34.2	47.6	116.3	Glasgow, Montana
Apr 01	1646	A52	8.2	43.0	122.6	
	1704	C54	27.4	36.6	97.3	Morse Hill, Mo.
	1710	B53	8.3	37.8	119.8	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Apr 02	1628	A53	37.0	33.9N	119.5W	
	1723	C55	31.6	36.6	94.8	
04	1625	C57	13.1	32.3	116.6	
09	1635	B61	14.4	38.8	118.7	Lodge Pole, Neb.
	1701	A58	18.6	43.8	120.7	James Bay, Moosonee, Ontario
	1738	C58	16.9	36.7	112.7	
10	1627	A59	10.1	43.6	120.7	1 S Kendrick, Wyo.
11	1535	C59	76.5	37.8	75.7	
	1717	B63	13.2	38.0	116.1	Hamblin, Brown County, Indiana
13	1655	C61	25.1	35.8	88.3	
14	0037	B67	8.4	37.8	114.8	
	1641	A63	56.4	33.8	76.1	
	1748	C62	8.2	34.3	110.5	
15	1625	A64	45.1	38.7	86.3	
	1655	C63	6.6	34.3	115.1	5E Young, Ariz.
	1713	B70	32.3	30.0	85.5	
16	1631	B71	6.0	38.3	118.0	6E Mt. Vernon, Ohio
17	1728	A65	8.5	43.8	120.6	9SW Logmount, Colorado
	1842	C65	68.8	46.9	71.6	
	1915	B72	7.8	36.8	117.8	
18	1557	C66	43.1	32.3	81.9	
	1639	B73	26.9	38.6	116.7	Proctor, Nevada

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Apr 20	1657	C68	83.6	35.2N	116.2W	
21	1644	B76	82.3	37.0	115.8	4SW Indian Springs AFB Nevada
22	1754	C69	45.1	36.2	96.5	12SE DeKalb, Ill.
23	1628	B79	56.5	28.1	94.7	Gulf of Mexico (Port Aronsas, Tex.)
24	1616	A70	7.7	45.8	118.9	
	1710	C70	39.8	36.7	116.0	75 SSE Tonopah, Nevada
25	1545	C71	54.8	34.3	81.5	
	1622	A71	15.6	47.2	122.0	
26	1430	C72	12.5	34.6	113.2	
	1853	B83	40.6	34.1	115.3	
28	1630	B84	9.0	33.1	113.7	Sabinas, Coahuila, Mexico
	1805	A72	35.9	49.6	121.7	
29	1623	C73	15.1	38.6	112.1	12W Missoula, Mont.
	1708	B85	29.4	42.3	120.2	
May 01	1604	E74	59.4	39.3	95.7	15NE Ste. Anne DuLac, Quebec
02	1504	E75	38.9	31.3	112.7	
	1624	V88	13.6	33.8	114.3	1 W Ariuaca, Ariz.
03	1514	E76	8.8	33.3	116.6	Plymouth, New York
	1646	T73	15.7	49.8	120.3	Burnstad, No. Dak.
	1650	V89	51.7	36.4	115.0	Salina Springs, Arizona
04	1637	V90	32.9	33.3	94.5	
07	1258	V91	19.0	38.7	117.2	
08	1648	T74	67.2	48.0	121.0	2-1/2SW Weantchee, Washington

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 May 09	1622	E79	81.6	31.5N	118.8W	26W-14N Tucson, Arizona
	1628	V93	13.5	36.3	114.9	5NE Potter, Neb.
	1642	T75	18.8	45.6	120.7	Deep Canyon Ione, Nevada
11	1615	T76	6.8	45.2	124.0	30N Fairfield, Idaho
	1805	V95	18.9	37.0	122.0	7E San Carlos, Arizona
12	1608	V96	19.9	34.1	115.1	17W Needles, California
13	1608	E80	45.9	41.3	91.0	
	1717	V97	57.7	44.7	84.2	
14	1559	E81	56.5	45.1	84.8	
	2144	V98	11.3	35.3	116.5	4-1/2E Heron Lake, Minnesota
15	1432	E82	55.0	44.7	83.3	
	1655	T77	14.1	43.2	121.2	15W Pentwater, Mich.
	1926	V100	7.1	35.3	118.5	Lancaster, Calif.
16	1610	E83	68.8	36.2	109.4	Cuervo, Guadalupe County, New Mex.
	1643	T78	9.2	42.8	122.4	
17	1530	E84	58.5	43.5	73.9	Beaver Harbor, N. Brunswick, Can.
	1625	T79	31.6	43.4	119.2	
	1655	V102	9.1	35.7	117.6	Macedonia, Ohio
18	1542	E85	54.8	29.3	90.3	Panama City, Fla.
	1712	V103	26.8	38.3	115.8	Garden County, Neb.
19	0902	V104	10.0	32.6	111.0	
20	1540	E87	55.8	31.7	83.4	6E Chula, Ga.
22	1540	E88	78.3	43.2	74.0	
24	1530	E90	9.5	38.8	111.8	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 May 25	1330	V109	12.5	47.2N	116.5W	
26	1610	V110	81.3	33.8	112.0	Ganado, Ariz.
June 03	1612	E93	17.3	37.0	111.6	Saratoga, Wyo.
	1653	V112	9.6	38.1	120.2	4N Maxbass, N.D.
04	1031	V114	18.5	33.5	109.2	
	1707	T80	9.5	44.3	124.3	Signal Point, Yellowstone Lake, Wyo.
05	1522	E95	28.1	36.6	105.8	
	1714	V115	12.3	36.3	115.5	Gloucester County, Va.
08	1630	E96	9.0	38.6	112.6	3N Maywood, Neb.
	1705	T82	7.9	45.8	124.8	
09	1555	E97	78.6	35.3	75.3	
11	1554	E98	31.6	50.3	120.2	
17	1602	E101	50.0	36.5	110.3	Kiowa, Colorado
	1645	T84	11.8	45.9	115.2	1-1/2E Glasgow, Montana
	1800	V120	10.5	35.8	123.5	15E Guadalupe Is., Mexico
18	1636	T85	10.4	47.4	117.5	Burmis, Alberta, Canada
20	1455	E102	64.6	35.0	88.3	10SW Belmont, Miss.
21	1642	E103	51.3	31.7	100.3	36NE Sonora, Texas
	1910	T86	27.3	49.7	116.5	
22	1658	V122	6.0	38.3	119.4	Meeker, Colorado
23	1655	T87	13.1	47.4	116.0	Wild Horse, Alberta, Canada
25	1617	T89	25.2	48.3	111.9	
	1645	V123	7.8	39.0	120.3	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 June 26	1643	V124	7.3	39.0N	117.8W	Orem Juab County, Utah
27	1545	E104	80.3	39.0	81.8	Gap Mills, W. Va.
28	1702	T90	25.0	49.7	118.5	
30	1650	V126	7.2	41.8	117.5	300NE Winnepeg, Canada
July 01	1604	E105	19.9	36.9	116.4	
03	1555	E106	9.1	37.5	117.4	9E Portland, Tenn.
	1617	T91	11.2	47.3	116.9	
04	1633	T92	28.0	44.6	126.5	15W Vancouver Is. Cape Scott, Canada
05	1633	T93	6.5	46.2	118.5	Bozeman, Mont.
06	1556	E107	29.6	40.6	120.2	9SW Norfolk, Neb.
	1633	T94	13.5	46.3	115.7	Maysville, Mo.
07	1620	T95	17.7	49.6	120.9	
08	1712	V131	11.8	40.2	118.3	NE Scotts Bluff, Neb.
12	1726	V132	9.6	41.5	119.0	Plumas County, California
14	1600	E110	57.5	35.2	119.2	Mojave, Calif.
16	1648	T96	22.2	45.0	114.7	Basin, Wyoming
17	1558	E111	51.5	34.1	122.0	
	1923	T97	18.6	46.5	114.8	3S Richmond, Ontario
19	1647	T98	10.7	46.2	117.8	50NW White Sulphur Springs, Mont.
	1728	V134	20.5	38.6	117.9	Holden, Utah
21	1657	T99	6.6	45.4	119.6	11-1/2E Gibbon, Ore.
22	1644	T100	11.8	48.8	117.5	
24	1711	T101	8.8	49.2	116.1	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 July 26	1700	T102	14.0	50.3N	117.0W	55.3N 76.6W
29	1642	T103	7.8	48.3	120.3	
30	1650	T104	7.7	48.1	119.9	
31	1600	E113	16.5	37.9	115.2	Rhame, Bowman County, No. Dak.
Aug 01	1655	T105	16.6	50.6	118.7	
	1814	V136	7.3	39.6	120.4	Cando, Saskatchewan, Canada
02	1415	E114	10.3	35.6	117.8	20N Zurich, Mont.
	1639	T106	17.4	49.8	118.7	Port Greville, Nova Scotia, Canada
04	1556	E115	6.1	37.1	115.9	
10	1723	T107	10.1	44.0	120.7	
11	1643	T108	26.3	46.2	113.2	
12	1620	E116	26.2	37.0	118.2	4SW Albion, Neb.
13	1750	V139	12.2	38.8	121.4	
14	1555	E117	7.6	36.7	117.5	10NW Wasatch, Utah
	1716	T110	91.7	33.7	75.7	Manns Harbor, N.C.
18	1559	V141	12.5	38.8	121.4	Randolph, Utah
	1609	E119	37.9	37.0	114.5	2WSW Winowa, Kansas
21	1551	E120	52.2	30.6	100.5	Fort McCouitt, Tex.
22	1443	E121	27.3	36.4	116.3	Black Hills, So. Dakota
25	1809	E122	9.9	37.0	114.7	6-1/2NW Forrest City, Arkansas
26	1700	V143	6.5	39.1	117.0	Cody, Wyoming
27	1708	E123	11.9	38.2	114.7	
30	1714	T112	33.3	41.2	120.7	Holyoke, Colorado

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Aug 31	1644	V145	14.8	35.3N	115.8W	70S St. George, Utah
Sept 01	1707	T113	5.9	45.3	122.2	
02	1609	E124	32.4	34.7	109.7	Jack Ward Township, New Mexico
06	1725	T116	25.6	47.1	115.8	Freeport, Ill.
08	1656	E126	7.6	35.5	116.8	Coyote Dry Lake, California
11	1708	T118	14.4	47.5	111.3	35W Meeker, Colorado
12	1740	T119	76.3	34.8	102.8	22W Hereford, Texas
13	1455	E127	10.6	36.0	117.8	
14	1724	T120	77.1	33.7	81.5	
15	1705	T121	8.4	46.9	119.7	2-1/2SW Maple Rapids, Michigan
16	1547	E128	65.7	37.4	123.1	
	1555	T122	7.6	44.7	121.0	2N Unionville, Mo.
	1654	V147	29.6	37.8	123.7	
18	1816	V148	26.2	38.4	122.5	Lexington, No. Car.
21	1711	T124	6.8	49.5	118.6	Sandy Lake, Manitoba, Canada
22	1705	E129	83.4	36.7	120.3	18E LeGrande, Calif.
23	1720	V149	32.7	30.6	103.3	8NW McCamey, Texas
24	1654	T125	46.7	41.2	78.4	
25	1721	V150	54.2	38.3	75.1	Fenwick Island, Del.
27	1701	V151	7.5	37.6	118.2	
Oct 03	1727	V152	25.6	36.5	123.2	
04	1639	V153	9.9	38.4	117.6	McGill, Nev.
05	1710	T127	51.8	38.2	113.0	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Oct 06	1927	T128	81.6	38.2N	73.5W	
07	1837	T129	14.4	45.6	114.7	
08	1740	V154	8.3	39.3	119.5	11S Georgetown, Colorado
11	1810	E132	76.3	40.7	122.0	
12	1727	T131	7.1	46.0	123.9	
13	1637	V155	31.4	46.1	123.3	Shelton, Wash.
15	1717	T132	27.7	49.3	123.3	
16	1112	M7	20.8	32.3	78.4	
	1941	E134	5.3	35.6	114.8	Gold Basin, Ariz.
17	1111	M8	40.8	32.1	78.9	
21	1110	M10	14.8	28.1	81.8	
	1840	E137	29.8	42.8	104.3	3-1/4W Appleton, Wis.
23	1740	T134	58.8	35.8	124.5	
25	1635	E138	77.6	45.2	68.3	
	1717	T135	25.7	41.0	124.7	10S McEwen, Oregon
26	1703	E139	70.0	36.3	115.2	70N Flagstaff, Ariz.
	1716	T136	14.7	44.8	123.7	Lame Deer, Montana
28	1727	E140	78.6	42.6	85.6	Vermontville, Mich.
29	1713	V158	80.6	43.8	70.6	
30	1747	V159	15.2	33.7	117.1	Ciudad Obregon, Sonora, Mexico
	1753	E141	6.6	33.3	115.7	
31	1538	E142	8.4	34.3	116.8	Mecca, Calif.
Nov 02	1755	T140	26.6	46.9	114.2	18NW Pipestone, Minn.
06	1716	V160	6.7	35.3	118.4	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1953 Nov 11	1416	M13	10.7	31.8N	77.4W	30N-6W
	1657	E144	7.6	35.3	115.0	Kingman, Ariz.
13	1722	T141	15.6	49.2	117.5	
15	1517	V162	15.7	31.9	118.8	Mazapil, Zacatecas, Mexico
18	1655	E147	16.6	34.3	108.8	
28	2147	E150	29.2	29.5	97.3	Castello Branco, Fayal, Azores
Dec 01	1415	M14	10.8	31.3	78.3	
02	1750	V164	16.2	34.2	118.6	19NW Albany, Texas
07	1717	S2	51.2	41.3	70.2	
	1836	V165	45.9	42.9	70.8	
08	1622	K3	12.6	43.0	81.4	Center, Texas
09	1701	E152	82.0	43.5	78.8	Half Moon Bay, Lake Ontario
	2340	T145	20.8	41.7	123.6	
11	1530	K5	8.5	40.3	94.4	Hobbs, New Mexico
	1714	E153	7.8	32.3	116.0	Mazatlan, Sinaloa, Mexico
15	1655	E154	11.1	34.5	110.0	
17	1536	K7	81.9	32.1	76.9	
	1753	T147	15.1	49.5	123.1	Alberta, Canada
18	1758	S8	11.0	34.4	85.7	
1954 Jan 05	2102	K9	97.0	36.2	76.0	
07	1745	E156	28.3	33.1	118.9	Pitt County, N.C.
09	1731	V166	16.0	32.8	107.5	San Angelo, Texas

Index by Launching Dates (cont.)

Date/Time		Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1954 Jan	28	1451	E159	36.2	34.3N	94.8W	
	30	1618	E160	25.7	28.5	102.0	
Feb	09	1511	E161	49.8	32.6	80.9	
	13	1707	E164	63.9	45.6	85.8	
	15	2033	V171	23.5	35.4	97.0	
	17	1527	E165	16.6	36.6	112.0	Durham, Kansas
	18	1714	V172	83.3	37.7	96.3	
	19	1453	E166	19.1	33.3	110.6	12E Clanton, Alabama
Mar	04	2313	K11	74.5	45.5	11.5	Plymouth, England
	09	1723	K12	30.5	34.9	63.9	
	11	1723	E167	81.1	30.8	111.7	35SE Sasobe, Sonora, Mexico
	15	1705	E168	83.4	44.6	83.6	
	18	1505	E169	56.6	35.1	104.4	
	19	1655	E170	60.6	30.6	79.6	
	21	1540	K15	43.6	44.0	46.5	South Geo. of Noss, Dunrossness, Shetland, Scotland
	26	1703	E172	20.5	40.4	81.3	
	27	1708	E173	19.9	32.8	85.3	
		1725	K18	40.8	40.8	63.0	
	31	1552	K19	32.9	40.2	67.8	36.4N 49.8W
Apr	01	1717	E175	62.7	30.5	75.8	
	02	1715	E176	57.8	29.0	92.2	30SW Ship Shoal Light, Gulf of Mexico
		2014	V174	32.8	33.6	81.5	
	03	1630	V175	40.0	32.3	79.9	
	07	1717	E178	32.7	38.5	87.6	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1954 Apr 10	1648	E181	32.7	37.2N	100.8W	9SE Bloom, Kan.
13	1638	E182	26.9	34.1	102.7	
14	1503	K20	65.2	22.2	59.2	
15	1644	E184	9.3	30.8	114.9	Long Beach, Long Island, N. Y.
17	1542	K22	64.6	47.4	65.8	Richibucto Beach New Brunswick, Can.
19	1705	E185	9.4	32.1	109.6	Cochise Dry Lake, Arizona
20	1643	E186	31.0	38.0	95.0	3NW Higbee, Mo.
21	1740	V176	57.3	35.0	104.0	Pinco Mesa, Tucumcari, New Mex.
22	1640	E187	32.8	35.2	96.3	4W 1S Indianola, Okla.
24	1600	K26	90.2	28.1	77.0	
	1639	E189	7.4	38.1	115.5	31.1N 47.5W
29	1547	E190	27.6	44.3	100.1	
	2343	K29	41.5	36.5	81.1	Rocky Mt., Va.
May 01	1640	V177	55.8	40.2	120.2	
02	1540	V178	10.8	31.4	113.2	
03	1613	E192	40.3	27.0	80.7	
04	1558	E193	28.5	31.4	78.3	
05	1354	K31	88.3	41.3	40.1	
	1619	V179	33.2	32.9	81.8	
06	1540	E194	33.3	27.6	83.0	75SW Tampa, Fla.
08	1528	E195	41.5	28.7	79.0	
10	1411	K35	14.3	36.7	87.7	4N Golconda, Ill.
	1530	E196	34.0	31.8	80.4	

Index by Launching Dates (cont.)

Date/Time	Launch	Flight Nos.	Duration (hrs.)	Last Airborne Fix		Impact
1954 May 11	1552	E197	28.1	27.4N	97.0W	3NE Galveston, Tex.
12	1547	E198	60.2	38.5	73.9	Henefer, Utah
	1604	V180	71.9	35.7	82.2	Floyd, Va.
13	1557	E199	44.1	32.0	80.3	
	1600	V181	7.0	37.5	116.1	
14	1535	E200	45.9	29.2	80.9	
15	2115	E201	24.3	34.0	119.7	
19	2015	K36	42.8	36.4	92.7	
29	1757	K39	9.3	38.9	90.8	3N Warrenton, Mo.
June 01	2137	K41	49.9	38.6	94.6	7W Sheldon, Mo.
02	1947	V185	25.7	37.5	96.5	
03	1538	V186	59.4	36.2	74.6	
05	1509	K44	57.9	37.9	100.2	Jetmore, Kansas
15	1547	V191	11.7	34.7	111.3	50S Flagstaff, Ariz.

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